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Moldovan et al.

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(54) **COMBINED POWER PACK UNIT**

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(52) **U.S. Cl.** **417/427**; 417/62; 417/286; 137/565.19; 137/565.29; 137/565.33; 60/468

(58) **Field of Classification Search** 417/62, 417/286, 426, 427; 60/468, 475, 486; 137/565.19, 137/565.29, 565.33; 418/8, 5, 6, 60
See application file for complete search history.

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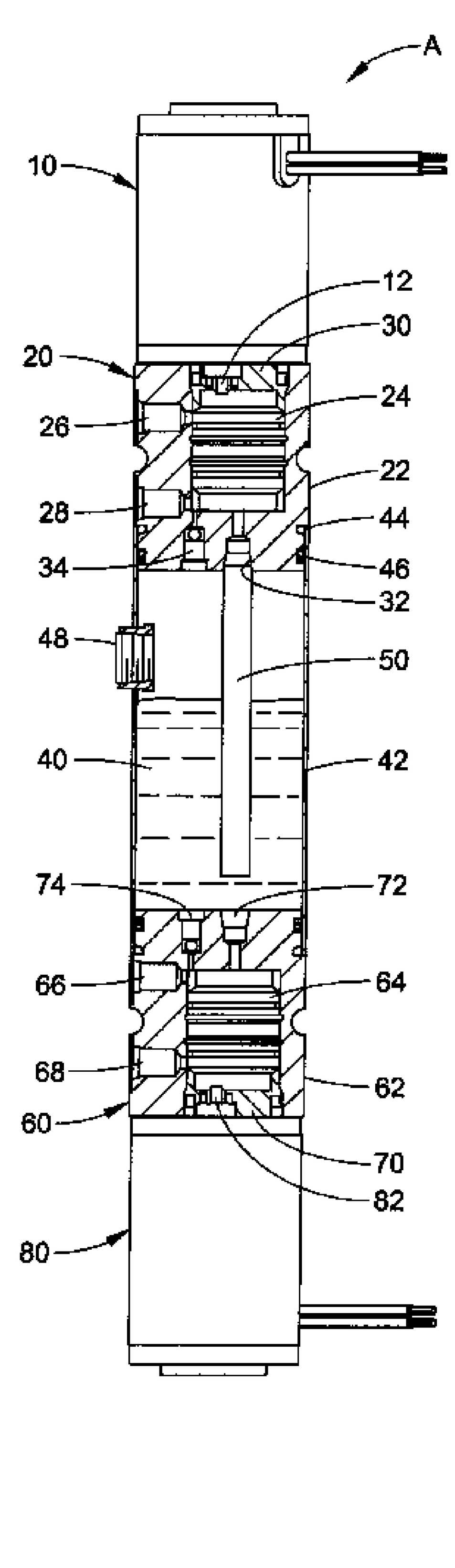
(57) **ABSTRACT**

A power pack unit includes a first hydraulic pump including a first pump enclosure accommodating a first pump cartridge. A second hydraulic pump includes a second pump enclosure accommodating a second pump cartridge. A hydraulic fluid reservoir is positioned between the first and second hydraulic pumps. A first end of the reservoir is secured to the first pump enclosure and a second end of the reservoir is secured to the second pump enclosure. The first and second hydraulic pumps and the reservoir can extend along a common axis. First and second motors can be connected to the first and second pumps. The entire structure can extend along a common axis.

11 Claims, 9 Drawing Sheets



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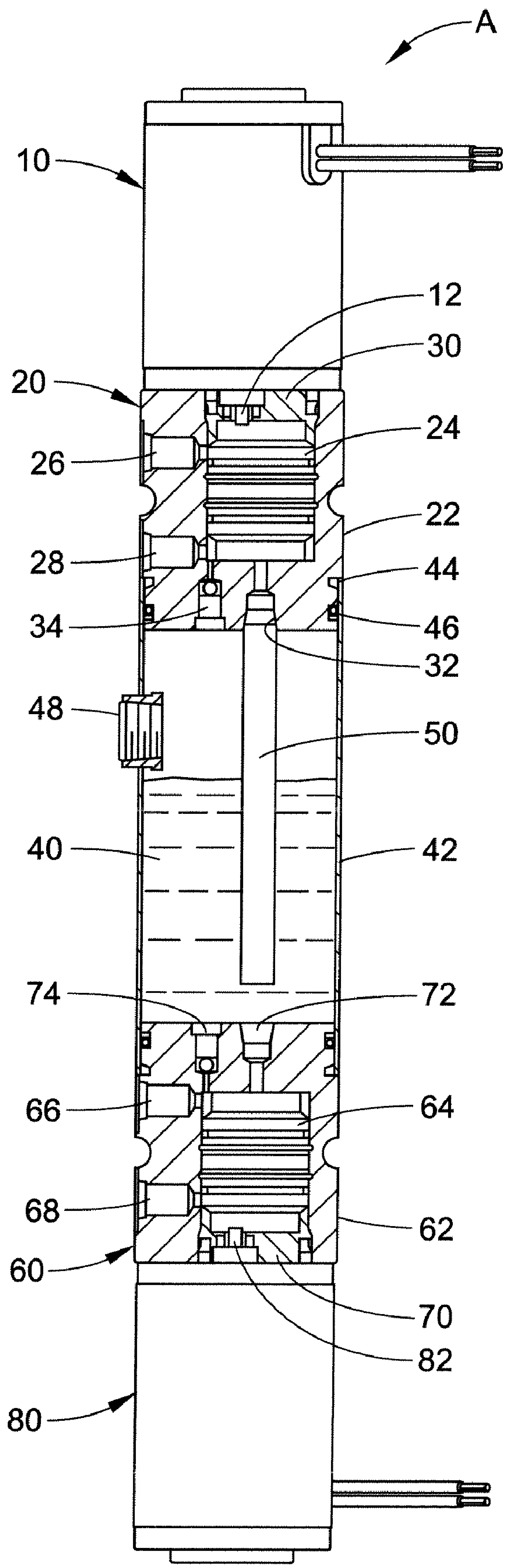
A
10
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26
22
28
44
34
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42
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72
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68
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60
70
82
80

FIG. 1

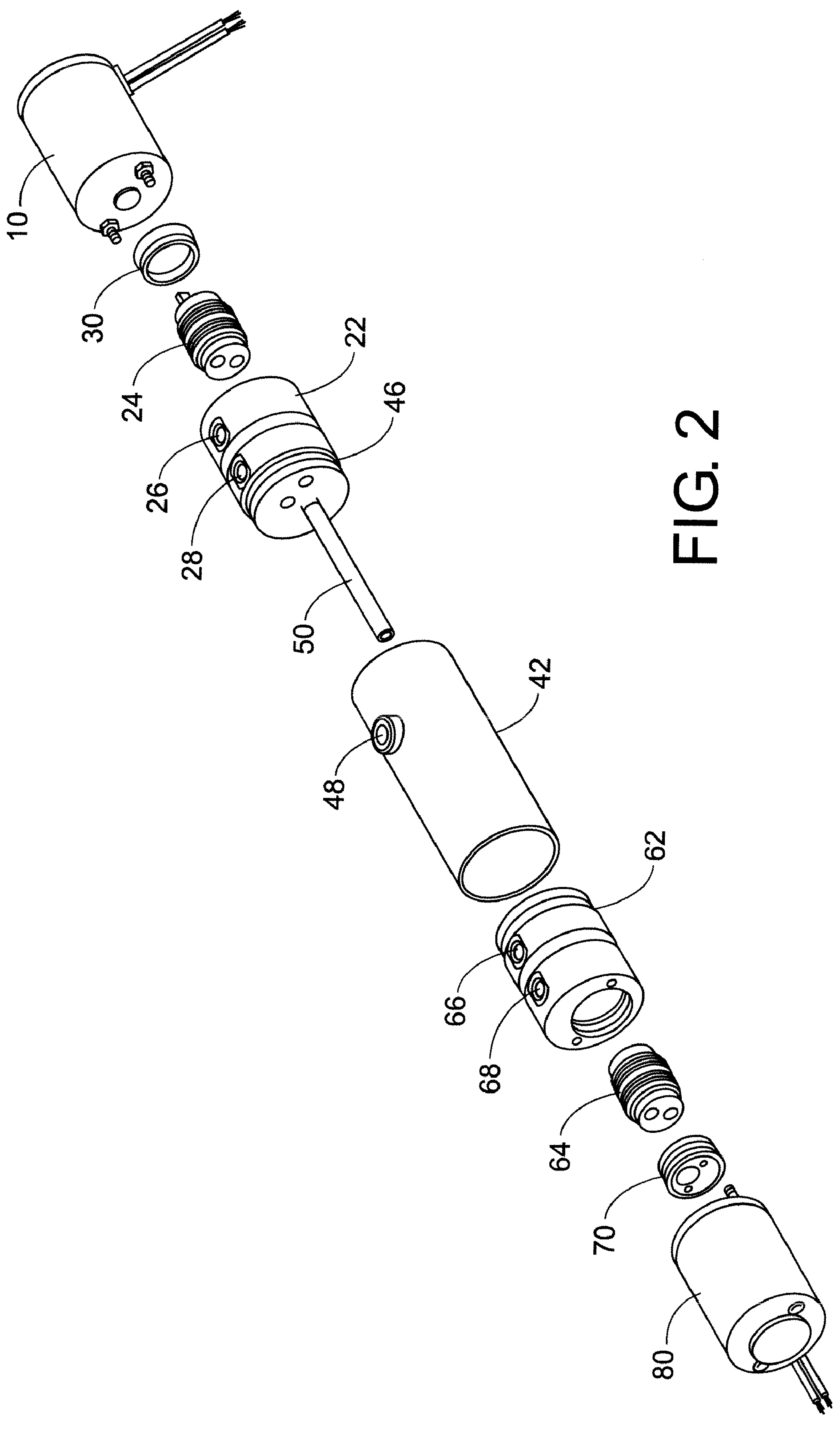

FIG. 2

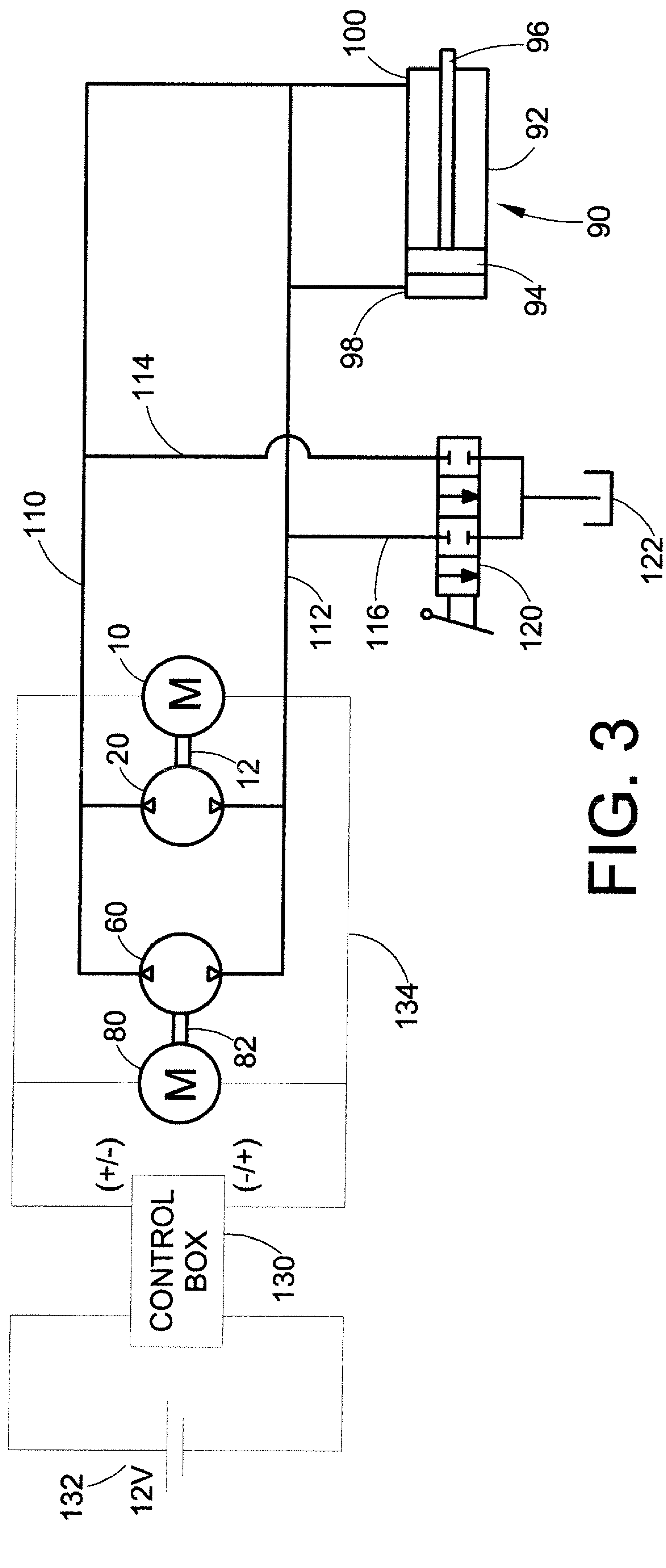
100
96
92
90
94
98
114
110
112
116
120
122
10
M
20
12
60
80
82
M
134
(+/-)
(-/+)
CONTROL BOX
130
132
12V

FIG. 3

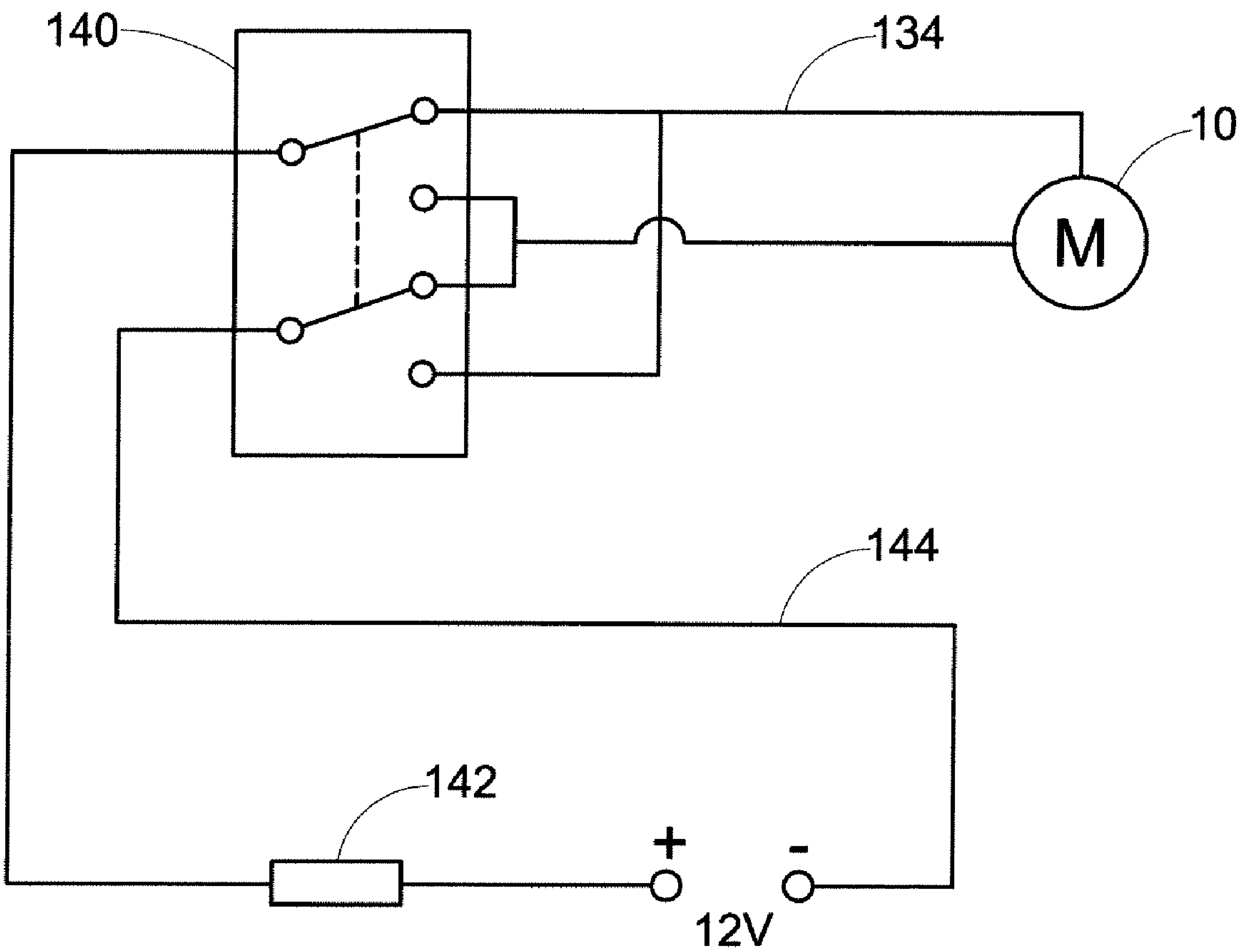

FIG. 4

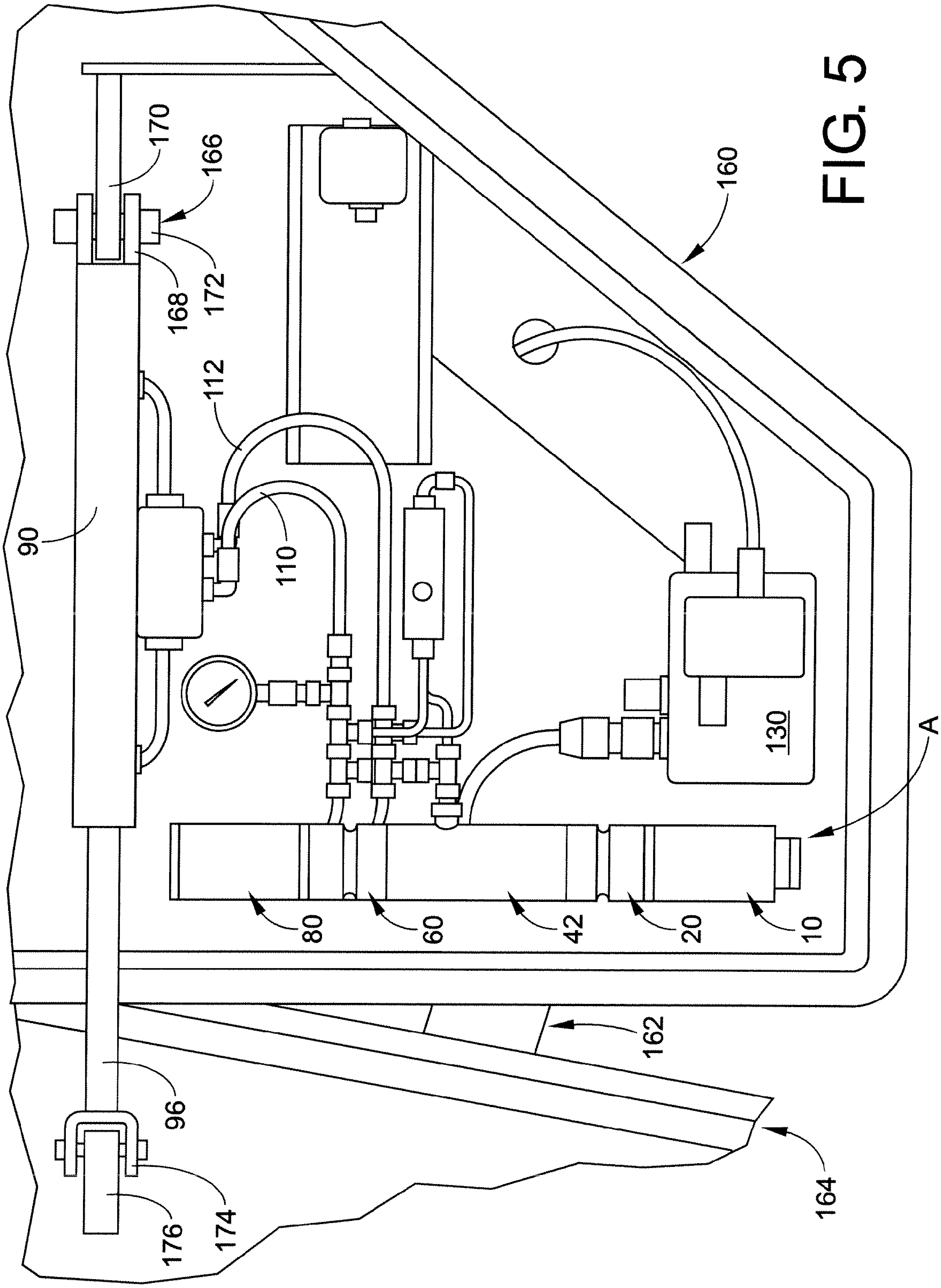
170
166
172
168
112
90
110
160
130
A
80
60
42
20
10
162
96
164
174
176

FIG. 5

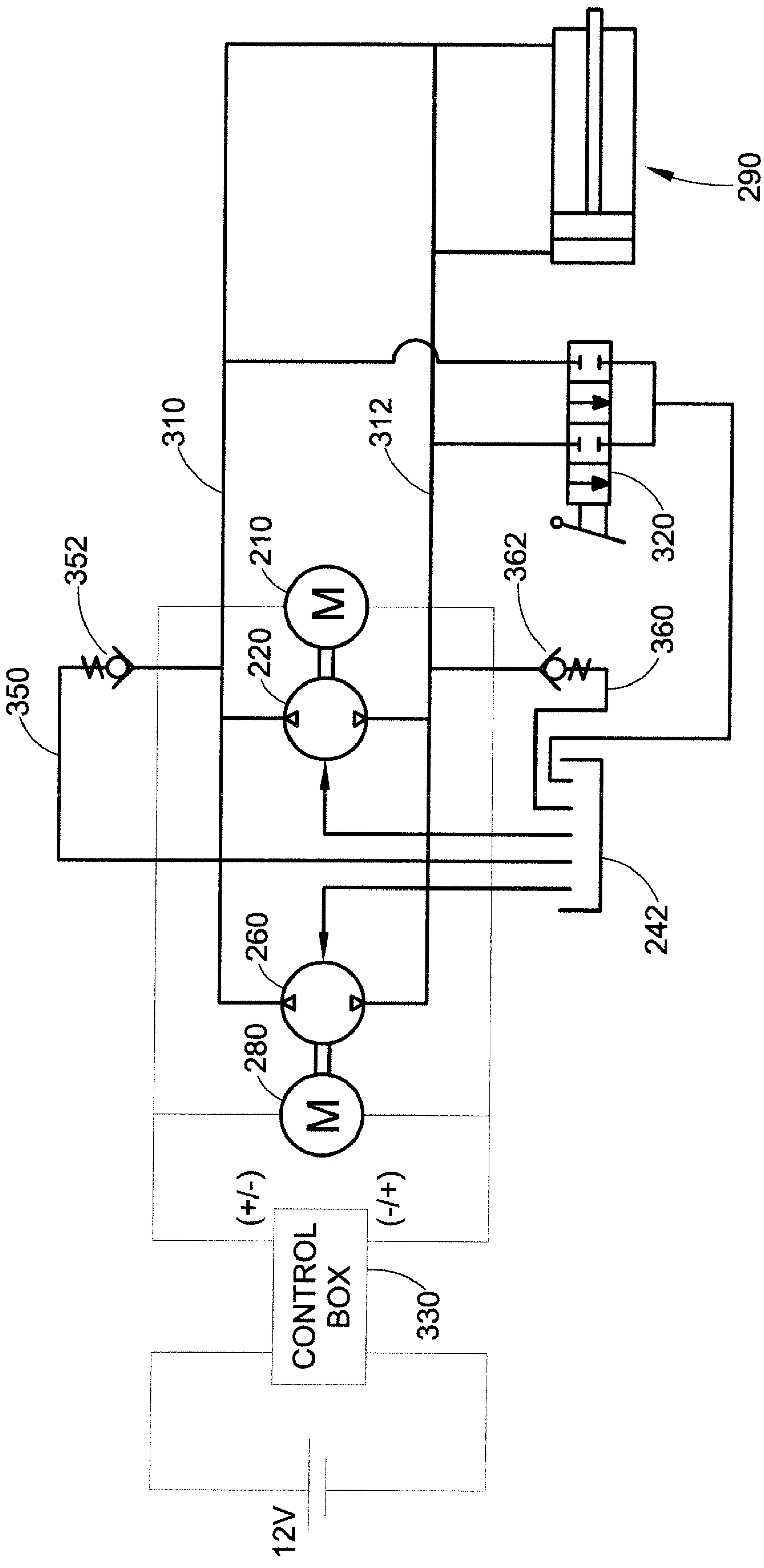
290
310
312
320
352
210
362
360
350
220
M
242
260
280
M
(+/-)
(-/+)
CONTROL
BOX
330
12V

FIG. 6

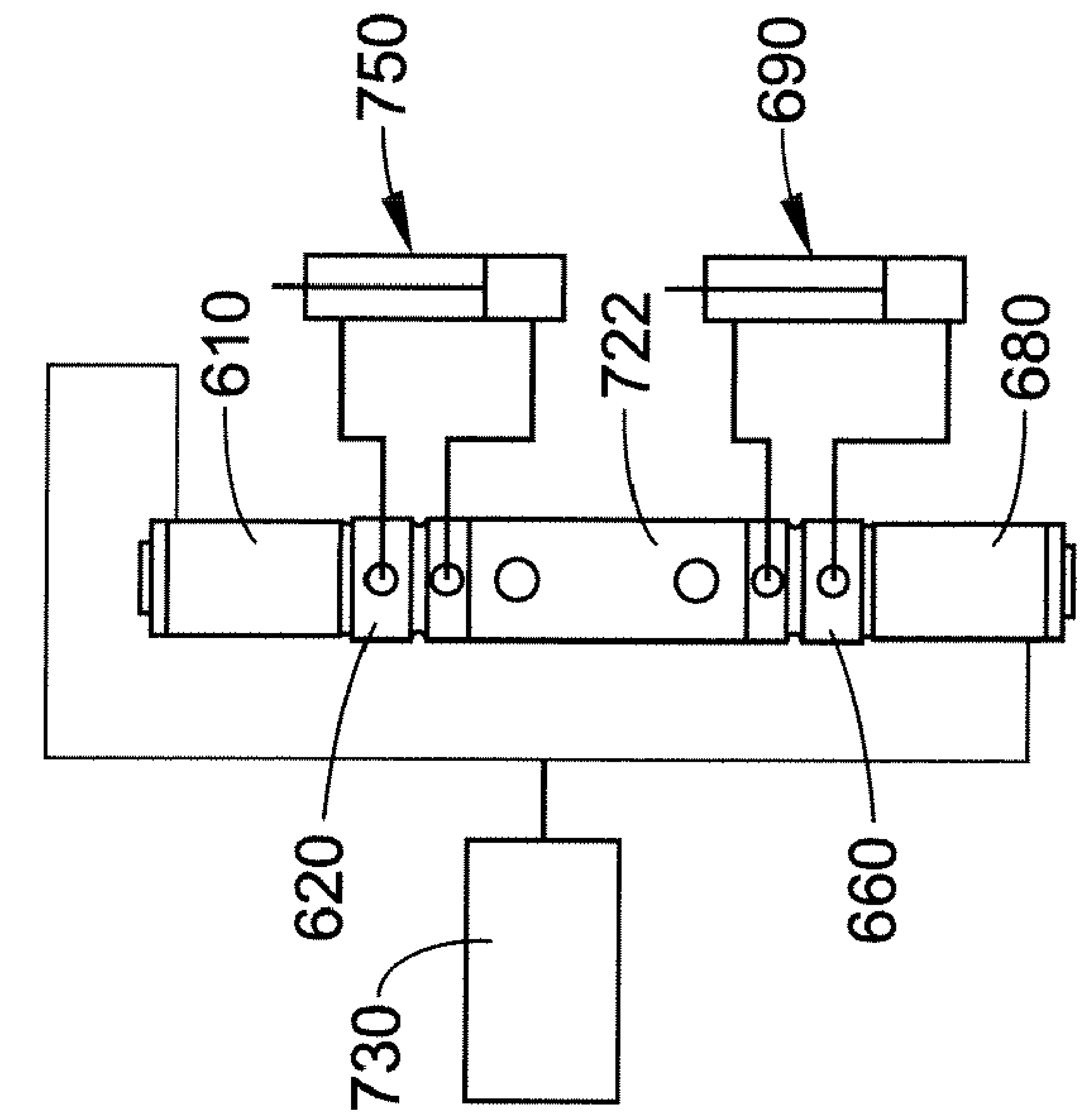

FIG. 11

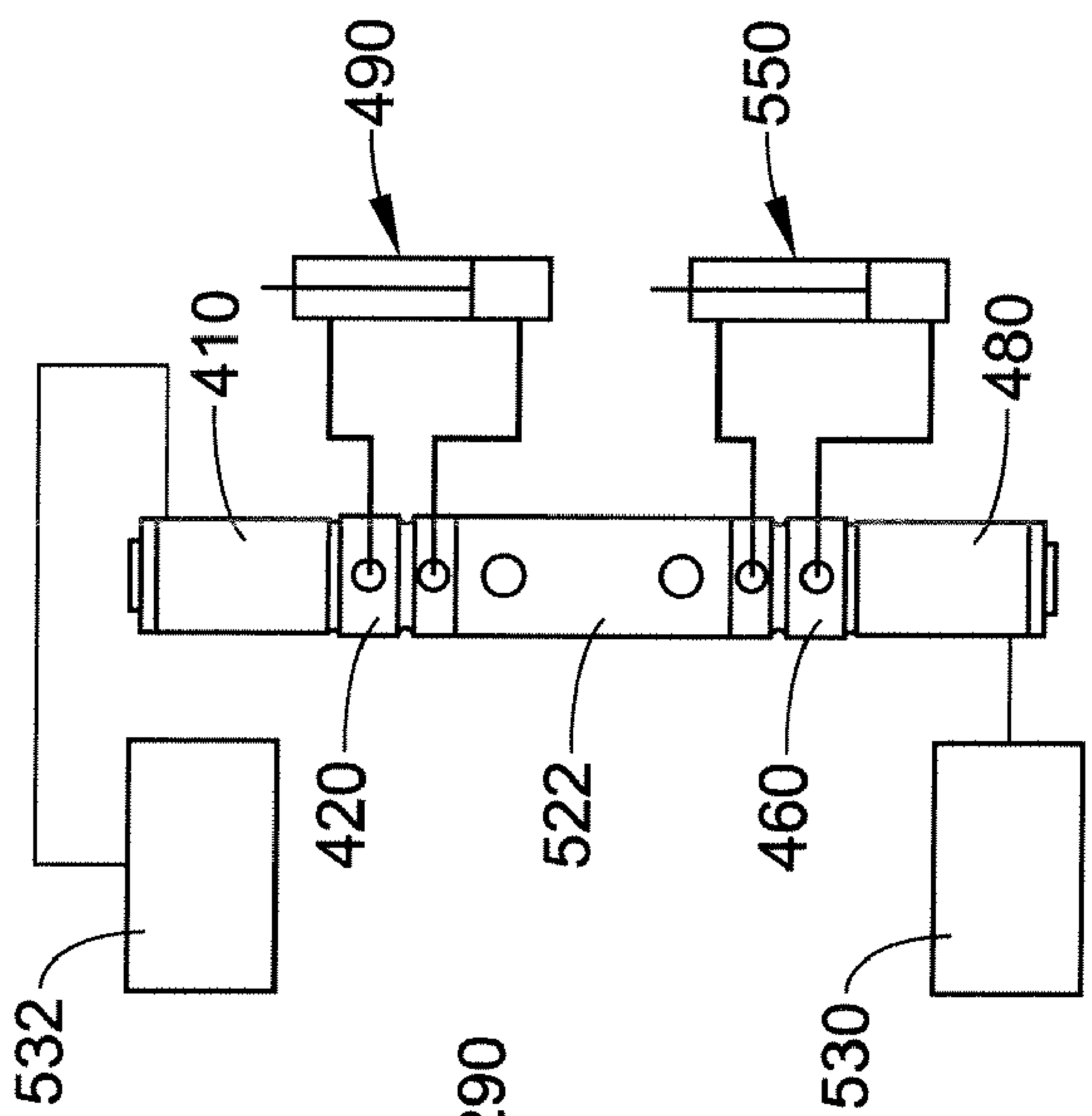

FIG. 9

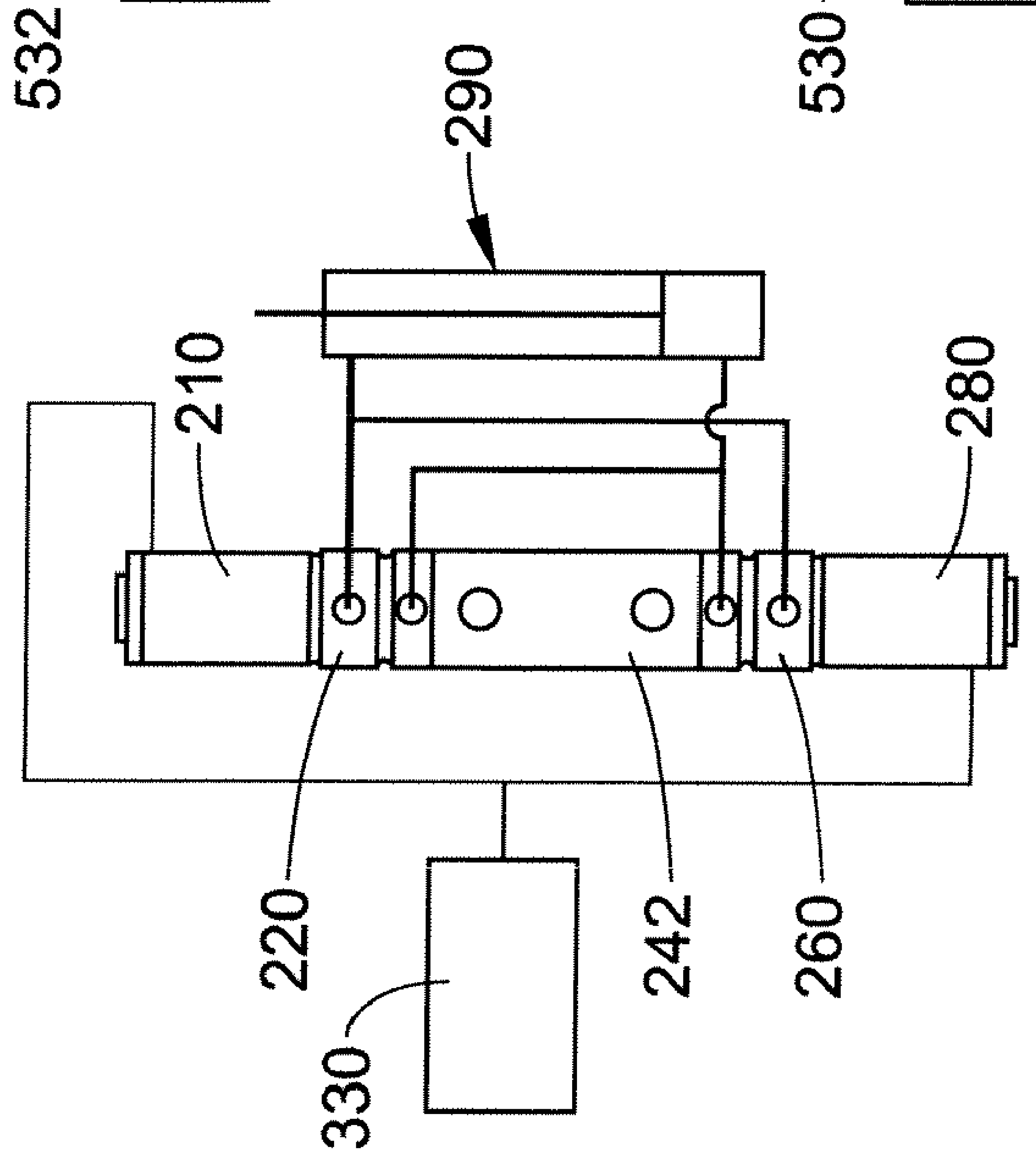

FIG. 7

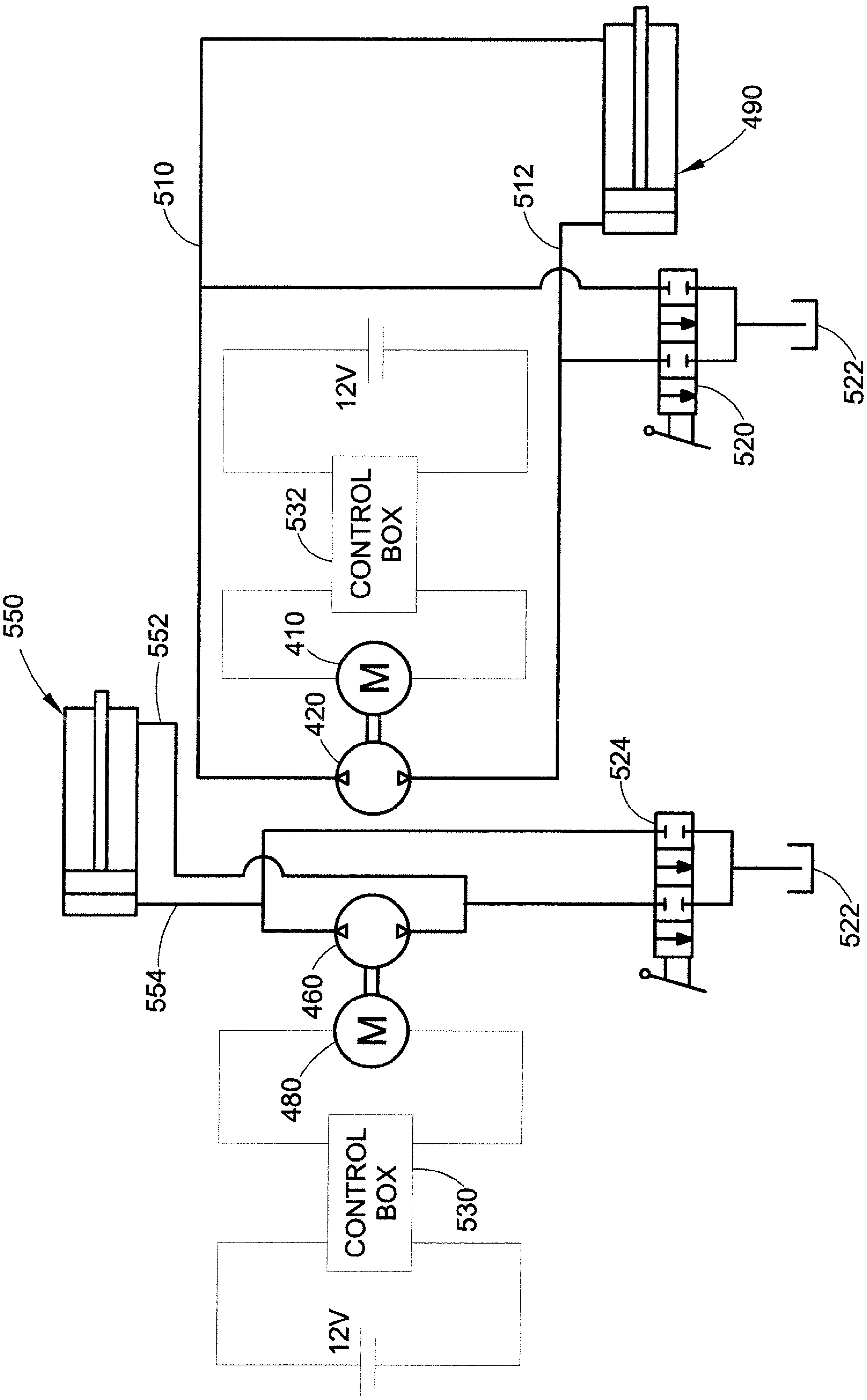
490
510
512
520
522
522
524
530
532
550
552
554
410
420
460
480
12V
12V
CONTROL BOX
CONTROL BOX
M
M

FIG. 8

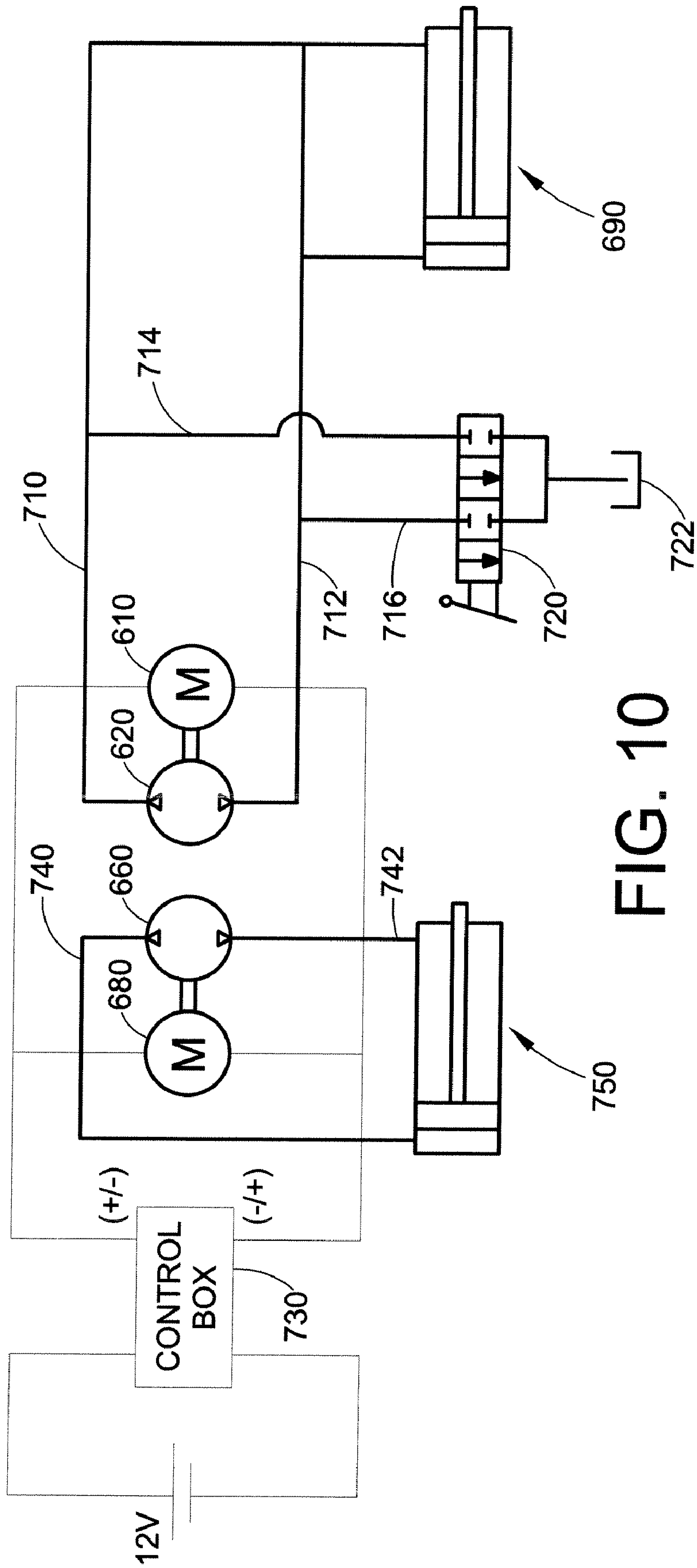
690
714
710
712
716
720
722
610
620
M
660
740
742
680
M
750
(+/-)
(-/+)
CONTROL BOX
730
12V

FIG. 10

COMBINED POWER PACK UNIT

BACKGROUND

The present disclosure relates to hydraulic power units. Such power units generally employ an electric motor driving a hydraulic pump.

Hydraulic power units are employed in a wide variety of applications. Such units provide pressurized flow to hydraulic motors, cylinders and other hydraulic components. Hydraulic power units differ from pumps because a hydraulic power unit contains a fluid reservoir, an electric motor, as well as a hydraulic pump stage driven by the electric motor. They may also include coolers to keep the hydraulic fluid at a safe working temperature. Performance specifications, physical characteristics and features are all important parameters to consider when evaluating hydraulic power units.

It is common to provide an electric motor in one housing and a hydraulic pump in another housing, with the two housings being positioned in line so that the motor and pump each have their own sets of bearings and shafts that are usually engaged through internal and external splines or through flexible couplings.

The electric motor driving the hydraulic pump can be either AC powered or DC powered. Typical applications for such power units include aerial platforms, car hoists, compactors, dock levelers, exercise equipment, factory automation and parking systems. Hydraulic power units can also be used in vehicle applications, such as, for example, opening or closing vehicle body components such as doors, hoods, tail gates or the like. In addition, they can be used for controlling the movement of snowplows attached to vehicles, such as all terrain vehicles (ATVs). In some spaced-limited applications, such as in vehicles, there is not enough room for two separate power units. Therefore, it would be advantageous to provide a compact power unit which accommodates space constraints but also meets power requirements.

BRIEF DESCRIPTION

One aspect of the present disclosure relates to a power pack unit comprising a first hydraulic pump comprising a first pump enclosure accommodating a first pump cartridge and a second hydraulic pump comprising a second pump enclosure accommodating a second pump cartridge. A hydraulic fluid reservoir is positioned between the first and second hydraulic pumps. A first end of a reservoir is secured to the first pump enclosure and a second end of the reservoir is secured to the second pump enclosure.

According to another aspect of the present disclosure, a power pack unit is provided. In accordance with this aspect of the disclosure, the power pack unit comprises a first hydraulic pump and a first motor which drives the first hydraulic pump. Also provided is a second hydraulic pump and a second motor which drives the second hydraulic pump. A hydraulic fluid reservoir is positioned between and communicates with the first and second hydraulic pumps. The first and second hydraulic pumps and the reservoir and the first and second motors extend along a common axis.

In accordance with a further aspect of the present disclosure, there is provided a hydraulic drive system for powering a hydraulic actuator. More particularly, in accordance with this aspect of the disclosure, the drive system comprises a first hydraulic pump driven by a first motor and a second hydraulic pump driven by a second motor. Also provided is an actuator assembly. A hydraulic circuit interconnects the hydraulic actuator with the first and second hydraulic pumps. Also provided is a control system which enables the hydraulic actuator assembly to be selectively driven by one of the first and second hydraulic pumps or by both the first and second hydraulic pumps, thereby affording both redundancy and variable drive speeds to the drive system.

In accordance with a still further aspect of the present disclosure, there is provided a hydraulic drive system comprising a first hydraulic pump driven by a first motor and a second hydraulic pump driven by a second motor. A hydraulic reservoir is located between and in communication with the first hydraulic pump and the second hydraulic pump wherein the hydraulic reservoir and the first and second hydraulic pumps are axially aligned. A first hydraulic actuator assembly communicates with the first hydraulic pump. A second hydraulic actuator assembly communicates with the second hydraulic pump. At least one control system enables the first and second hydraulic pumps to operate independently and actuate the first and second hydraulic actuators independently of each other.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure may take physical form in certain parts and arrangements of parts, several embodiments of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part hereof and wherein:

FIG. **1** is a front elevational view, partially in cross section, of a power pack unit according to a first embodiment of the present disclosure;

FIG. **2** is an exploded perspective view of the power pack unit of FIG. **1**;

FIG. **3** is a hydraulic and electrical circuit diagram of the power pack unit of FIG. **1** when connected to a hydraulic piston and cylinder assembly;

FIG. **4** is an electrical circuit diagram of a control unit for a portion of the power pack unit of FIG. **1**;

FIG. **5** is a perspective view of an embodiment of the power pack unit of FIG. **1** in use to assist in the movement of a vehicle door;

FIG. **6** is a hydraulic and electrical circuit diagram of a second embodiment of the present disclosure;

FIG. **7** is another diagram illustrating the single cylinder configuration of the embodiment of FIG. **6**;

FIG. **8** is a hydraulic and electrical circuit diagram of a third embodiment of the present disclosure;

FIG. **9** is another diagram illustrating the independent dual cylinder configuration of the embodiment of FIG. **8**;

FIG. **10** is a hydraulic and electrical circuit diagram of a fourth embodiment of the present disclosure; and,

FIG. **11** is another diagram illustrating the connected cylinder configuration of FIG. **10**.

DETAILED DESCRIPTION

Referring now to the drawings, wherein the showings are for purposes of illustrating the several embodiments of the present disclosure only and not for purposes of limiting same, FIG. **1** shows a first embodiment of a power pack unit A. In this embodiment, there is provided a first electric motor **10**. Communicating therewith is a drive shaft **12** of a first or upper pump assembly **20**. If so desired, the first pump may be a hydraulic pump. The first pump assembly comprises a pump enclosure **22** which includes an internal cavity and a pump cartridge **24** disposed therein. The pump cartridge can be, for example, a compact, bi-directional pump capable of pressurizing hydraulic fluid in two opposite directions by rotation of the pump in two opposite directions. One embodiment of such a pump is illustrated in U.S. Pat. No. 6,979,185 dated Dec. 27, 2005. The disclosure of this patent is incorporated hereinto by reference in its entirety. Disclosed therein is a compact bi-rotational gear pump for pressurizing hydraulic fluid that can be used to move a piston in a cylinder.

Communicating with the pump cartridge **24** are pressure/return ports **26** and **28** located in a spaced manner on the pump enclosure **22**. The ports **26** and **28** will serve as either pressure ports or return ports depending upon the direction of rotation of the bi-rotational gear pump. Also mounted to the pump enclosure is a pump retainer **30** (see FIG. **2**). Located on the pump enclosure is a reservoir suction port **32**, and, spaced therefrom, a conventional relief valve **34**. A reservoir **40** is connected to the pump enclosure **22**. The reservoir comprises a cylindrical or tubular housing **42** which is secured by crimping **44** to the pump enclosure **22** and is sealed to the pump enclosure by suitable conventional seals **46**. Of course, other known ways of connecting the housing to the pump enclosure could also be used. Located in the housing **42** is a fill port **48**. Extending into the reservoir **40** is a suction tube **50** connected at a proximal end to the reservoir suction port **32** of pump enclosure **22**. It should be appreciated that this embodiment of the power pack unit is vertically oriented, hence the need for the suction tube **50**. If the power pack unit were meant for a horizontal orientation, such a suction tube may not be necessary. It should be appreciated that as hydraulic fluid is necessary for the pump assembly **20**, it is drawn from the reservoir **40** through the tube **50** and into the pump enclosure **22** via the reservoir suction port **32**. If there is an overpressure situation in the pump, hydraulic fluid can be relieved back into the reservoir **40** via relief valve **34**.

Disposed on a distal end of the reservoir **40** is a second or lower pump assembly **60**. The second pump comprises a pump enclosure **62** in which there is positioned a pump cartridge **64**. The pump cartridge can, similarly, be a bi-directional pump cartridge such as is disclosed in the U.S. Pat. No. 6,979,185 mentioned above. Located in the pump enclosure **62** are spaced first and second ports **66** and **68**, which can be pressure ports or return ports, depending upon the direction of pumping of the bi-directional pump cartridge **64**. Connected to the pump enclosure **62** is a pump retainer **70** (FIG. **2**). Also provided on the pump enclosure is a suction port **72**, as well as a relief valve **74**, spaced therefrom. Powering the second pump **60** is a second electric motor **80**. To this end, a drive shaft **82** of the pump is physically engaged with a suitable socket on the motor **80**.

With reference now to FIG. **3**, there is shown a hydraulic cylinder **90** in the form of a piston and cylinder unit which is selectively actuated by the power pack unit. The cylinder **90** comprises a tube **92** in which there is positioned a piston head **94** that can move axially in the tube. The piston head is connected to a piston rod or actuator rod **96** having a distal end which extends out of the cylinder. Provided on the cylinder is a first port **98** which is disposed proximal of the piston head **94** and a second port **100** which is disposed distal of the piston head.

A first hydraulic fluid line **110** communicates the first and second pumps **20** and **60** with the second port **100**. A second hydraulic fluid line **112** communicates the first and second pumps **20** and **60** with the first port **98**. Thus, hydraulic fluid can be provided either through the first port **98** or through the second port **100** thereby moving the piston head **94** in a desired direction and, in this way, moving the piston rod or actuator rod **96** as necessary. In this way, the piston rod can be used to actuate a desired component of the system to which the cylinder is connected. A third fluid line **114** and a fourth fluid line **116** respectively communicate the first and second fluid lines **110** and **112** with a relief valve **120**. This can be a manual relief valve if so desired. The relief valve allows hydraulic fluid to selectively flow into a sump **122**. The sump may be different from, or the same as, the common reservoir **40** illustrated in FIG. **1**.

A control box **130** includes suitable controls for actuating the first and second motors **10** and **80** and, hence, powering the first and second hydraulic pumps **20** and **60**. The control box electrically communicates with a power supply **132**. It also electrically communicates with the first and second pumps **10** and **80** via suitable electric lines **134**. The construction is such that an instant and positive change in direction of the piston **94** is achieved by appropriate actuation of the electric drive motors **10** and **80**. Such actuation is controlled by the control box **130**. As with most controllers these days, the control box **130** can include a microprocessor.

It should be appreciated that a single one of the motors **10** or **80** can be employed to provide pressurized hydraulic fluid to move the piston **94** in the cylinder **92** in one of two opposite directions at a first speed. Alternatively, both motors **10** and **80** can be employed, thereby driving the piston in the desired direction at a second, higher, speed. This construction of the power pack unit affords both redundancy and variable drive speeds for the actuator **90**.

With reference now to FIG. **4**, in one embodiment, the control box can include a switch **140** which selectively actuates, for example, the motor **10**. The switch **140** communicates with a power supply via electric lines **142**, in which there can be located a fuse **144**. It can be seen that moving the switch **140** will reverse polarity and, hence, reverse the rotational direction of the motor **10**. The switch can be a conventional rocker switch of the type sold by Carling as Model No. VLD1S00B. It should be appreciated that each motor **10**, **80** can be a 12 volt motor, which is the reason why a 12 volt power supply is illustrated in FIG. **4**.

With reference now to FIG. **5**, the power pack unit can be used to selectively move a door **160** of a vehicle to an open position or a closed position, as desired. The door **160** can be mounted by suitable conventional hinges **162** to a frame **164** of the vehicle. It can be seen that the actuator unit **90** can be positioned in the door, as can the power pack unit A. More particularly, the actuator unit **90** can be connected via a pivot connection **166** to the door **160**. To this end, the pivot connection can comprise a clevis **168** connected to the cylinder **92** and a hinge member **170** mounted to the door. A hinge pin **172** can extend through aligned apertures in the clevis **168** and the hinge member **170**.

A piston rod end **96** of the actuator unit **90** can include a mounting member **174** pivotally connected to a mounting element **176** secured to the vehicle frame **164**. In this embodiment, the power pack unit A can be used to selectively actuate the piston and cylinder unit **90** in order to assist in opening and closing the door **160** of the vehicle. It should be appreciated that in this embodiment, the power pack unit A and the actuator unit **90** are disposed along a different longitudinal axes. This is simply due to the structure of the door **160**. If, however, the power pack unit and actuator were used on a different vehicle body component, perhaps a large tailgate or the like, the two units could be aligned axially. Moreover, in the embodiment illustrated in FIG. **5**, the two units are oriented approximately perpendicular to each other. However, in a different embodiment, the two could be aligned along parallel axes, if so desired. It should be appreciated that the interior door skin is removed from the embodiment illustrated in FIG. **5**. Thus, the power pack A and the actuator **90** would be hidden behind the interior door panel or skin during normal use. One of the advantages of the design illustrated in FIG. **5** is that the power unit or power pack A has a compact diameter in relation to its pressure output. Therefore, a smaller diameter package offering the same hydraulic power as a unit with a single larger motor is provided. But, since the package is smaller in diameter, it can fit in spaces which would be too small or too narrow to accommodate a single unit with the same hydraulic power. The inline arrangement also enables the power pack unit to be mounted in the restricted space afforded by the interior of a vehicle door.

Performance specifications to consider when selecting hydraulic power units include operating pressure, flow, total power and reservoir capacity. The operating pressure is the pressure the power unit can deliver at the outlet. The pressure of the power unit may be expressed as a single pressure rating or it can be rated to operate over a range of pressure. For example, the power unit can have a range of 600-2,500 psi. The fluid flow through the power unit may be a single rating or have low and high rating points. In one embodiment, the fluid flow can be on the order of one gallon per minute. The total amount of power the motor/pump can draw, or as rated to operate can be, for example, 20 amps at 12 volts or 10 amps at 24 volts.

Such power units or power packs can have multiple power sources, so that the necessary power can be available from any desired source or a combination of sources. In addition to electric motors as disclosed in the embodiment of FIGS. **1**-**5**, such power units could be driven by other types of motors, such as internal combustion motors or the like. Power is measured in horsepower or similar units. These power units can range from 0.03 horse power to 0.40 horse power with the currently used electric motors. Of course, with larger electric motors, the power units can have a higher horse power, such as one, two or three horse power, or even larger. The capacity of the power unit reservoir is measured in gallons, cubic centimeters, or similar units. For example, the design illustrated in FIGS. **1** and **2** can have a capacity of 396 cubic centimeters (cc). Of course, the units may have reservoirs with a range of capacities. For example, if the reservoir is, for example, 20 inches long, then the capacity can be up to 1500 cc. Larger reservoirs are also contemplated. The displacement of the pumps **20** and **60** can, in one embodiment, be 0.35 cc. While such a displacement is adequate for the compact unit disclosed in FIGS. **1** and **2**, different, larger, displacements are contemplated for larger power units.

Physical specifications to consider for hydraulic power units include the pump type, power source, cooling method and available space for mounting the unit. All hydraulic power units have some type of integrated pump. A particular type of gear pump has been illustrated in the first embodiment discussed above. However, there are many other types of pumps available as well. Some units are available with multistage pumps which perform like multiple pumps connected in series. Pump types available for hydraulic power units includes single stage, double stage, three or more pump stages and multiple pump units. Power sources include not only electric motors, such as has been disclosed above in the first embodiment, but also diesel engines, gasoline engines and pneumatic compressors.

Some power units are cooled, such as by heat exchanger or fan driven oil coolers. Other power units are only cooled passively by radiation and convection. Another important consideration for power units is their unit weight. In the embodiment illustrated in FIG. **5**, it is noted that the cylinder is not axially aligned with the power pack. One reason for this is that such a system would likely be too long for the vehicular door application illustrated in FIG. **5**. In the door system illustrated in FIG. **5**, the power unit would be actuated via a toggle switch or the like (such as is shown in FIG. **4**) to move the door from one position to another.

With reference now to FIG. **6**, another embodiment of the present disclosure is there illustrated. In this embodiment, there is provided a first motor **210** which drives a first pump **220** and a second motor **280** which drives a second pump **260**. It is noted that both pumps **220** and **260** are illustrated as being bi-directional pumps. Both pumps **220** and **260** draw fluid from a common reservoir **242**. If desired, the common reservoir can be positioned between the pumps, as in the embodiment of FIGS. **1** and **2** above. A control box **330** actuates the two motors **210** and **280** and, hence, powers the two pumps **220** and **260**. It should be appreciated that the control box can include a microprocessor and appropriate software in a memory to allow the control box to direct the operation of the motors.

In this embodiment, the two pumps **210** and **260** communicate with a cylinder unit **290** via suitable hydraulic lines **310** and **312**. Also provided is a manual relief valve **320** which similarly communicates with the reservoir **242**. Further communicating with the reservoir **242** and the first hydraulic line **310** is an additional hydraulic fluid line **350**, in which is located a thermal relief valve **352**. A second hydraulic fluid line **360**, in which there is also located a thermal relief valve **362**, communicates with a second fluid line **312**. Thus, this embodiment of the disclosure incorporates thermal relief valves to manage any overpressure of the hydraulic fluid due to heating the fluid used in the system.

With reference now to FIG. **7**, disclosed therein is a single cylinder configuration of the type previously illustrated in FIGS. **3** and **6**. In this configuration, the motors **210** and **280** are connected in parallel and run together at the same speed. Therefore, almost twice the flow of hydraulic fluid is provided by the pumps **220** and **260** to the cylinder **290** as compared to a single power pack unit employing one gear pump driven by an electric motor. This embodiment would use twice the current of a single power pack. However, the pressure rating could be the same as a single power pack. That pressure rating, depending on the motor, could be from 1500 PSI to 2000 PSI. The benefit of this embodiment is that there is provided redundant cylinder operation. If one motor or pump fails, then the other one is capable of moving the load, albeit at about half the speed.

With reference now to FIG. **8**, shown there is another embodiment of the present disclosure. This embodiment comprises a first motor **410** which selectively powers a first pump **420** and a second pump **460** which is selectively powered by a second motor **480**. The first pump **420** selectively actuates a first actuator or piston and cylinder assembly **490** via suitable first and second hydraulic lines **510** and **512**. Connected to these lines is a first manual relief valve **520**. The first pump is powered by the first motor **410** which is controlled by a suitable control box **532**.

The second pump **460** is selectively powered by the second motor **480**, which is controlled by a separate second control box **530**. The second pump **460** communicates with a second actuator or hydraulic piston and cylinder **550** via suitable hydraulic fluid lines **552** and **554**. These fluid lines also communicate with a hydraulic reservoir, such as **522**, via a manual relief valve **524** if so desired. A common hydraulic fluid reservoir **522** can be provided for both hydraulic circuits if so desired. In one embodiment, the common hydraulic reservoir **522** is positioned between the two pumps **420** and **460** to provide a compact power pack design. Alternatively, two separate hydraulic fluid reservoirs could be employed.

In this embodiment, the two motors **410** and **480** can run at different speeds, or independently, so as to allow the two pumps **420** and **460** to run at different speeds, or independently, as well. As a result, the two actuators **490** and **550** can be operated independently of each other. If the motors are 12 volt DC motors, the power supply for each of them is also at 12 volts. In this embodiment, each control box would be provided with its own switches. Nevertheless, a compact design can be achieved for the power pack system.

In another embodiment, the power pack unit, such as A, can be aligned with a cylinder unit, such as **90**, in order to form an actuator. Moreover, the control system **130** could be so configured as to enable the cylinder assembly **90** to be selectively driven by one or both of the hydraulic pumps **20** and **60** should that be desired. It should also be appreciated that if only one of the pumps **20** and **60** is in use, the other pump would be locked. In other words, it would not run in reverse.

With reference now to FIG. **9**, disclosed therein is an independent dual cylinder configuration, along the lines of the design in FIG. **8**. In it, the first pump **420** selectively actuates the first piston and cylinder assembly **490** and the second pump **460** selectively actuates the second piston and cylinder assembly **550**. The motors are connected to separate control units **530** and **532** and can, thus, run independently and actuate the cylinders independently.

With reference now to FIG. **10**, a further embodiment is there illustrated. In this embodiment, there is provided a first pump **620** which is powered by a first motor **610** and a second pump **660** which is powered by a second motor **680**. The first pump **620** selectively actuates a first piston and cylinder assembly **690** via suitable first and second hydraulic lines **710** and **712**. Connected to these lines is a first manual relief valve **720**, via fluid lines **714** and **716**. The second pump **660** communicates with a second hydraulic piston and cylinder assembly **750** via suitable hydraulic fluid lines **740** and **742**. For ease of understanding, the hydraulic fluid reservoir communicating with the first and second lines **740** and **742** is not illustrated. However, it can be the same as the reservoir **722**. Moreover, fluid flow through lines **740** and **742** can be controlled by a suitable valve, such as the valve **720**. In this embodiment, the two motors **610** and **680** are controlled by a common control box **730**. Therefore, they would be running at roughly the same speed. In order to be fully synchronized, however, the two cylinders **690** and **750** would need to be mechanically linked by a conventional linkage means.

FIG. **11** illustrates such a design. However it does not show the mechanical linkage of the two cylinders **690** and **750**.

The disclosure has been described with reference to several embodiments. Obviously, modifications and alterations will occur to others upon a reading and understanding of this specification. It is intended to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

The invention claimed is:

1. A power pack unit comprising:

a first hydraulic pump;

a first motor which mechanically drives said first hydraulic pump;

a second hydraulic pump;

a second motor which mechanically drives said second hydraulic pump;

a hydraulic fluid reservoir defined within a hydraulic fluid reservoir housing, the hydraulic fluid reservoir housing being positioned between and adjacent to the first and second hydraulic pumps, the hydraulic fluid reservoir fluidly communicating with the first and second hydraulic pumps;

the first and second hydraulic pumps, the hydraulic fluid reservoir housing, and the first and second motors being arranged to extend along a common axis;

the first and second hydraulic pumps being exterior to the hydraulic fluid reservoir thereby establishing a distance between the first and second hydraulic pumps measured along the common axis through the hydraulic fluid reservoir; and,

a suction tube for supplying hydraulic fluid to the first hydraulic pump, the suction tube extending into the hydraulic fluid reservoir from the first hydraulic pump toward the second hydraulic pump a distance at least 50% of the established distance between first and second hydraulic pumps.

2. The unit of claim **1** wherein at least one of said first and second hydraulic pumps comprises a bidirectional pump.

3. The unit of claim **1** further comprising a control system for selectively actuating at least one of the first and second motors.

4. The unit of claim **1** wherein at least one of said first and second motors comprises an electric motor.

5. The unit of claim **1** wherein said first motor is located on a distal end of said first hydraulic pump and said second motor is located on a distal end of said second hydraulic pump.

6. The unit of claim **1**, wherein the hydraulic fluid reservoir housing comprises a tubular structure, at least one of the first or second pumps being at least partially telescopically received within the hydraulic fluid reservoir housing.

7. The unit of claim **6**, further comprising a seal element for sealing a radially inner surface of the hydraulic fluid reservoir housing to a radially outer surface of the at least one of the first or second pumps.

8. The unit of claim **6**, wherein the hydraulic fluid reservoir housing is cylindrical, and wherein the first and second pumps are partially telescopically received in respective ends of the hydraulic fluid reservoir housing, whereby the hydraulic fluid reservoir housing and pumps define an interior volume of the hydraulic fluid reservoir.

9. The unit of claim **1** wherein said first hydraulic pump includes a first pump enclosure accommodating a pump cartridge.

10. The unit of claim **9** wherein said pump cartridge comprises a bidirectional pump unit.

11. The unit of claim **9** further comprising:

a first pressure/return port located on said first pump enclosure;

a second pressure/return port located on said first pump enclosure and spaced from said first pressure/return port; and,

a suction port located on said first pump enclosure and communicating with said reservoir.

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